

In the Claims

This listing of claims replaces all prior versions or listings of claims in this application:

1. (currently amended) An apparatus for spraying powders, comprising:
 - a) a housing having first and second opposed ends, the housing defining a chamber terminating in an outlet passageway at said first end of the housing;
 - b) a high voltage pin electrode positioned in the chamber spaced upstream of the outlet passageway, the high voltage pin electrode having a first surface area;
 - c) a ground surface electrode positioned in the chamber spaced upstream from the high voltage pin electrode, the ground surface electrode having a second conducting surface area that is sufficiently larger than the first surface area of said high voltage pin electrode to give a pin-to-surface electrode configuration such that when a high voltage is applied to the high voltage pin electrode, an electrical field produced in a vicinity of the ground surface electrode is sufficiently low to prevent arc discharging occurring in the vicinity of the ground surface electrode in the chamber; and
 - d) an inlet opening into the chamber for conducting a powder-gas mixture into the chamber.

2. (currently amended) The apparatus according to claim 1 including means for supplying a cleaning gas toward the high voltage pin electrode to reduce powder deposits on the high voltage pin electrode.
3. (original) The apparatus according to claim 2 wherein the inlet for conducting a powder-gas mixture into the chamber is located at the second end of the housing.
4. (currently amended) The apparatus according to claim 3 wherein the high voltage pin electrode includes at least one charging pin connected to a conductor located in an electrically insulated tube disposed along an axis of the housing, the conductor being connectable to a power supply for applying high voltages to the at least one charging pin.
5. (currently amended) The apparatus according to claim 4 wherein the chamber defines an inner cylindrical surface and the ground surface electrode is a cylindrical electrode having an outer diameter such that the cylindrical electrode is substantially concentric with the inner cylindrical surface, the cylindrical electrode having an inner surface which has the second conducting surface area that is sufficiently larger than the first surface area of the high voltage pin electrode.

6. (currently amended) The apparatus according to claim 5 wherein the means for supplying a cleaning gas to reduce powder deposits on the high voltage pin electrode includes the electrically insulated tube.
7. (currently amended) The apparatus according to claim 4 wherein the chamber defines an inner cylindrical surface and the ground surface electrode includes a plurality of sections of a cylindrical electrode mounted around the inner cylindrical surface with each section being separately or jointly grounded, the sections of the cylindrical electrode having inner surfaces which cumulatively ~~[[have]]~~ define the second conducting surface area that is sufficiently larger than the first surface area of the high voltage pin electrode.
8. (currently amended) The apparatus according to claim 5 wherein a first section of the chamber upstream of the high voltage pin electrode containing the ground surface electrode has a cross sectional area which is less than that of a second section of the housing containing the high voltage pin electrode in order to increase a velocity of the powder-gas mixture flow within the first section and to create turbulence in order to keep the ground surface electrode from being coated by powder.
9. (currently amended) The apparatus according to claim 5 wherein a first section of the chamber upstream of the high voltage pin electrode containing the ground surface electrode includes an insulated cylindrical member disposed

symmetrically along the axis of the housing for narrowing the chamber in the first section in order to increase a velocity of the powder-gas flow and to create turbulence in order to keep the ground surface electrode from being coated by powder.

10. (currently amended) The apparatus according to claim 9 wherein the housing has a portion surrounding the insulated cylindrical member disposed symmetrically along the axis which has a radius which is larger than a radius of a portion of the housing surrounding the high voltage pin electrode.

11. (currently amended) The apparatus according to claim 9 wherein said insulated cylindrical member disposed symmetrically along the axis of the housing has a downstream end portion, and wherein the ground surface electrode includes an electrical conductor mounted on the downstream end portion so that electrical field lines are developed between the high voltage pin electrode and both the cylindrical electrode and the electrical conductor.

12. (currently amended) The apparatus according to claim 4 including an insulated cylindrical member disposed symmetrically along the axis of the housing having a downstream end portion spaced upstream of the high voltage pin electrode, and wherein the ground surface electrode includes an electrical conductor mounted on the downstream end portion of insulated cylindrical

member so that electrical field lines are developed between the high voltage pin electrode and the electrical conductor.

13. (withdrawn and currently amended) The apparatus according to claim 4 including an electrically insulated cylinder having a diameter greater than an outer diameter of said electrically insulated tube and less than the inner diameter of a section of the chamber adjacent to the second end of the housing and symmetrically aligned with the axis, the electrically insulating cylinder having one end located at the second end of the housing and an opposing end positioned a distance downstream of a downstream end portion of the ground surface electrode, and wherein the inlet opening for conducting a powder-gas mixture into the chamber located at the second end of the housing is an annular region defined by the one end of the electrically insulated cylinder and the insulated tube.

14. (withdrawn and currently amended) The apparatus according to claim 13 wherein the chamber defines an inner cylindrical surface and the ground surface electrode includes a cylindrical electrode having an outer diameter such that the cylindrical electrode is substantially concentric with the inner cylindrical surface, the cylindrical electrode having an inner surface which ~~[[has]]~~ defines the second conducting surface area that is sufficiently larger than the first surface area of the high voltage pin electrode, and wherein the cylindrical electrode has an inner diameter greater than the diameter of the electrically insulated cylinder.

15. (withdrawn and currently amended) The apparatus according to claim 14 wherein the means for supplying a cleaning gas toward the high voltage pin electrode includes means for injecting the cleaning gas into the electrically insulated tube.

16. (withdrawn and currently amended) The apparatus according to claim 14 including means for supplying additional cleaning gas into an annular region located between the one end of the electrically insulated cylinder and the second end of the housing to prevent buildup of powder on the ground surface electrode.

17. (withdrawn and currently amended) The apparatus according to claim 13 wherein the ground surface electrode is a generally cylindrical electrode mounted on an outer surface of the electrically insulating cylinder, the generally cylindrical electrode having an outer surface which ~~[[has]]~~ defines the second conducting surface area that is sufficiently larger than the first surface area of the high voltage pin electrode.

18. (withdrawn and currently amended) The apparatus according to claim 17 wherein the means for supplying a cleaning gas toward the high voltage pin electrode includes means for injecting the cleaning gas into the electrically insulated tube.

19. (withdrawn and currently amended) The apparatus according to claim 17 including means for supplying additional cleaning gas into an annular region located between the one end of the electrically insulated cylinder and the second end of the housing to prevent buildup of powder on the ground surface electrode.

20. (withdrawn and currently amended) The apparatus according to claim 2 wherein the inlet opening for conducting a powder-gas mixture into the chamber is located at a position in the housing located between the ground surface electrode and the high voltage electrode whereby the powder-gas mixture is introduced into the chamber downstream of the ground surface electrode and whereby powder particles acquire a charge as they move downstream toward the high voltage pin electrode to be ejected from the chamber through the outlet passageway.

21. (withdrawn and currently amended) The apparatus according to claim 20 wherein the chamber defines an inner cylindrical surface and the ground surface electrode includes a cylindrical electrode having an outer diameter such that the cylindrical electrode is substantially concentric with the inner cylindrical surface, the cylindrical electrode having an inner surface which ~~[[has]]~~ defines the surface area that is sufficiently larger than the first surface area of the high voltage pin electrode.

22. (withdrawn and currently amended) The apparatus according to claim 21 wherein the second end of the housing includes a gas inlet for flowing gas through the cylindrical ground surface electrode for avoiding powder deposit buildup on the cylindrical ground surface electrode.

23. (withdrawn and currently amended) The apparatus according to claim 22 wherein the housing has a generally cylindrical shape and has a cylindrical axis, and wherein the high voltage pin electrode includes at least one charging pin connected to a conductor located in an electrically insulated tube disposed along an axis of the housing, the conductor being connectable to a power supply for applying high voltages to the at least one charging pin.

24. (withdrawn and currently amended) The apparatus according to claim 23 wherein the means for supplying a cleaning gas toward the high voltage pin electrode includes a gas passageway in the electrically insulated tube.

25. (withdrawn and currently amended) The apparatus according to claim 23 wherein the inlet opening for conducting the powder-gas mixture into the chamber includes a conduit attached to the housing at an angle greater than 90 degrees with respect to the outlet passageway so that powder is directed into the chamber in a downstream direction away from the ground surface electrode.

26. (withdrawn and currently amended) The apparatus according to claim 20 including an insulated cylindrical member disposed symmetrically along an axis of the housing between the second end of the housing and the inlet for conducting a powder-gas mixture into the chamber, the insulated elongate cylindrical member having a downstream end portion spaced upstream of the high voltage pin electrode, and wherein the ground surface electrode includes an electrical conductor mounted on the downstream end portion of the insulated cylindrical member so that electrical field lines are developed between the high voltage pin electrode and the electrical conductor.

27. (withdrawn and currently amended) The apparatus according to claim 26 wherein the second end of the housing includes a gas inlet for flowing gas adjacent the ~~cylindrical~~ ground surface electrode for avoiding powder deposit buildup on the ~~cylindrical~~ ground surface electrode.

28. (withdrawn and currently amended) The apparatus according to claim 27 wherein the housing has a generally cylindrical shape, and wherein the high voltage pin electrode includes at least one charging pin connected to a conductor located in an electrically insulated tube disposed along the axis of the housing, the conductor being connectable to a power supply for applying high voltages to the at least one charging pin.

29. (withdrawn and currently amended) The apparatus according to claim 28 wherein the means for supplying a cleaning gas toward the high voltage pin electrode includes a gas passageway into the electrically insulated tube.

30. (withdrawn and currently amended) The apparatus according to claim 28 wherein the inlet opening for conducting the powder-gas mixture into the chamber includes a conduit attached to the housing at an angle greater than 90 degrees with respect to the outlet passageway so that the powder-gas mixture is directed into the chamber in a downstream direction away from the ground surface electrode.

31.-42. cancelled

43. (withdrawn and currently amended) The apparatus according to claim 13 wherein the chamber defines an inner cylindrical surface and the ground surface electrode includes a plurality of sections of a cylindrical electrode mounted around the inner cylindrical surface with each elongate section being separately or jointly grounded, the sections of the cylindrical electrode having inner surfaces which cumulatively ~~[[have]]~~ define the second conducting surface area that is sufficiently larger than the first surface area of the high voltage pin electrode.

44. (withdrawn and currently amended) The apparatus according to claim 20 wherein the chamber defines an inner cylindrical surface and the ground surface

electrode includes a plurality of elongate sections of a cylindrical electrode mounted around the inner cylindrical surface with each elongate section being separately or jointly grounded, the sections of the cylindrical electrodes having inner ~~surface~~ surfaces which cumulatively ~~[[have]]~~ define said second conducting surface area that is sufficiently larger than the first surface area of the high voltage pin electrode.

45. (withdrawn and currently amended) The apparatus according to claim 5 wherein the high voltage pin electrode includes at least one charging pin mounted on the inner cylindrical surface spaced upstream from the outlet passageway.

46. (withdrawn and currently amended) The apparatus according to claim 13 wherein the high voltage pin electrode includes at least one charging pin mounted on the inner cylindrical surface spaced upstream from the outlet passageway.

47. (withdrawn and currently amended) The apparatus according to claim 20 wherein the high voltage pin electrode includes at least one charging pin mounted on the inner cylindrical surface spaced upstream from the outlet passageway.